

REMARKS

Claim rejections – 35 U.S.C. §103 – Claims 1-8

In the latest Office Action, claims 1-8 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Chalasani et al. (US 6,080,345) in view of Theodore et al. (US 4,615,861). Chalasani et al. teach a method of forming powder mixtures which include a binder, a solvent for the binder, a surfactant, and a “non-solvent” such as an oil or wax. While the Examiner acknowledges that Chalasani et al. do not teach the claimed polymeric binder system or heating the thin-walled green article and sintering the article as claimed, she asserts that it would have been obvious to employ the resin mixtures and sintering step of Theodore in the process of Chalasani.

However, there is no motivation for one skilled in the art to do so. Applicants first wish to point out that the solvent used by Chalasani et al. does not function in the same way as the solvent of the present invention. As taught in the present invention, the organic solvent is selected from a class of solvents which are solvents for the glassy-elastomeric segment of the thermoplastic (elastomer) block copolymer binder component of the polymeric binder system. See the specification at page 6, lines 15-17, page 2, lines 9-10 and amended claim 1. The solvent functions to release the crosslinks formed by the glassy segments of the block copolymer, thus reducing the viscosity of the binder system to allow mixing of the binder system and powder at temperatures below 100°C. See the specification at page 5, lines 21-23, page 6, lines 3-5, and new claim 29.

In addition, the use of thermoplastic elastomer polymeric binders as taught in the present invention help to maintain the shape of the article during burnout and sintering as the elastomeric network which is formed after extrusion has a very high viscosity.

Chalasani et al. do not teach a polymeric binder system including a thermoplastic elastomer polymeric binder as claimed, but rather teach that the preferred binders are aqueous-based, i.e., cellulose ether binders. See col. 6, lines 20-21.

Further, there is no motivation to combine Chalasani et al. with Theodore as Theodore et al. require the use of heat to achieve mixing of their binder composition. As taught in the present invention, the use of an organic solvent allows the preparation of the binder system without the use of high temperatures as well as removal of the solvent by evaporation at temperatures below 100°C, i.e., about 50°C. See the specification at page 5, lines 9-13 and new claims 28 and 29. As Theodore et al. do not teach or suggest the use of an organic solvent, they require heat to achieve mixing of their binder composition. See col. 9, lines 56-63. Nor is there any teaching or suggestion in either Chalasani et al. or Theodore et al. which would motivate one skilled in the art to combine a thermoplastic elastomer polymeric binder and an organic solvent as claimed.

Further, Chalasani et al. do not teach a method in which the binder is first combined with a solvent to form a homogeneous solution prior to addition of the ceramic or metal powder as claimed, but rather teach that the powder materials, surfactant, and binder are mixed *prior* to addition of the solvent. In addition, Chalasani teach only partial removal of the solvent in their mixture, while substantially all of the solvent of the present invention is evaporated. The present invention teaches away from incomplete evaporation of the solvent as it results in surface defects and pores in the extruded green body. See Example 4. Accordingly, claim 1, as amended, and claims 2-8, which depend therefrom, are clearly patentable over the combination of Chalasani et al. and Theodore et al.

Claim rejections – 35 U.S.C. §103 – Claims 9-12

Claims 9-12 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Chalasani in view of Takeuchi et al. (US 5,733,499). While the Examiner acknowledges that Chalasani et al. do not teach the use of benzene or toluene as solvents, or the use of yttria-stabilized zirconia as a ceramic powder, she asserts that it would have been obvious to use such components in view of Takeuchi et al., who teach a method for making a ceramic substrate in which a ceramic powder is mixed with an organic binder (e.g., poly(vinyl butyral), ethyl cellulose) and an organic solvent. Again, there is no motivation to make the proposed substitution. Neither Chalasani et al. nor Takeuchi et al. teach or suggest the use of a thermoplastic elastomer polymeric binder as recited in claim 1, from which claims 9-12 depend. Nor do Chalasani et al. or Takeuchi et al. teach evaporation of the solvent as recited in claim 1. In fact, Takeuchi et al. teach away from evaporation of the solvent. See col. 1, lines 60-63. Claims 9-12 are clearly patentable over the combination of Chalasani et al. and Takeuchi et al.

Claim rejections – 35 U.S.C. §103 – Claim 13

Claim 13 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Chalasani in view of the Liang et al. article. The Examiner has cited Liang et al. for teaching the use of yttria-stabilized zirconia in combination with nickel oxide for forming a tubular solid oxide fuel cell. Again, the Examiner has provided no substantive reasoning as to why one skilled in the art would be motivated to use the powder of Liang et al. in the process of Chalasani. Applicants wish to point out that it is well known in the art that binders and binder systems are not neutral chemical systems that can be formed successfully using any arbitrary ceramic or metal powder. Chemical interactions between the binder and powders may occur which can adversely affect

Serial No. 09/683,031
Docket FRD 0190 PA (200-1215)

processing of the mixture during forming, and potentially, the performance of the end-product. There is no teaching in the Liang et al. article which would motivate one skilled in the art to use Liang's powder in the binder system of Chalasani.

Even if one were to make the proposed substitution, the claimed invention would not be met as neither Liang et al. nor Chalasani et al. teach or suggest the steps of providing a polymeric binder system including a thermoplastic elastomer polymeric binder and an organic solvent, adding a ceramic or metal powder, evaporating the organic solvent, and extruding the mixture from a die as recited in claim 1, from which claim 13 depends.

Conclusion

For all of the above reasons, applicants submit that claims 1-13, as amended, and new claims 28 and 29, are patentable over the cited references. Early notification of allowable subject matter is respectfully requested.

Respectfully submitted,

KILLWORTH, GOTTMAN, HAGAN
& SCHAEFF, L.L.P.

By Susan M. Luna
Susan M. Luna
Registration No. 38,769

One Dayton Centre
One South Main Street, Suite 500
Dayton, Ohio 45402-2023
Telephone: (937) 223-2050
Facsimile: (937) 223-0724